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[Claim(s)]

[Claim 1] In the laser-beam-machining apparatus for valve-seat welding a metal ingredient of an engine cylinder head The laser radiation apparatus which irradiates a laser to a valve-seat part, and the installation base for holding a cylinder head in a predetermined location, The rotation means for being prepared in a machine stool and rotating said installation base to the circumference of a predetermined revolving shaft, Said installation base can be freely moved continuously in a two-dimensional flat surface. It is the laser-beam-machining apparatus characterized by having an installation base positioning device for coinciding the hole-axis alignment and said predetermined revolving shaft of the valve-seat part to process, and an installation base positioning device intervening between said installation base and said rotation means.

[Claim 2] It is [the description and] a laser-beam-machining apparatus smoothly about the installation base include-angle alteration device in which the include angle to said revolving shaft can change said installation base by predetermined within the limits further being established in a laser-beam-machining apparatus according to claim 1.

[Claim 3] The laser radiation apparatus which irradiates a laser to a valve-seat part, and the installation base for holding a cylinder head in a predetermined location, The rotation means for being prepared in a machine stool and rotating said installation base to the circumference of a predetermined revolving shaft, Can move said installation base continuously freely in a two-dimensional flat surface, and it intervenes between said installation base and said rotation means. The installation base positioning device for coinciding the hole-axis alignment and said predetermined revolving shaft of the valve-seat part to process, The laser-beam-machining apparatus equipped with the installation base include-angle alteration device in which the include angle to said revolving shaft can change said installation base by predetermined within the limits is used. After termination of laser beam machining which makes the 1st valve-seat

part weld a metal ingredient, In performing laser beam machining of the 2nd valve-seat part, the 2nd hole-axis alignment and said revolving shaft of a valve-seat part are coincided according to said installation base positioning device and said installation base include-angle alteration device. The laser-beam-machining approach characterized by processing it, rotating an installation base to the circumference of said revolving shaft where the location adjusted to after an appropriate time by the installation base positioning device and the installation base include-angle alteration device is fixed.

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to what is called a laser cladding processing apparatus with which irradiate a laser beam at the valve-seat part of an engine cylinder head, and a valve-seat part is made to weld a cylinder-head ingredient and a different ingredient, and the laser cladding processing method using the apparatus.
[0002]
[Description of the Prior Art] Since the valve-seat part formed in an engine cylinder head serves as a hit side with a valve, it is the part as which heat resistance and endurance are required, and generally usually pressing the dissimilar-metal sintered alloy of a copper system fit, and securing heat resistance and endurance is performed. However, since it is necessary to secure press fit cost and a design degree of freedom may be restricted in manufacture by this pressing method, what is called the laser cladding processing method that welds [valve-seat part] a cylinder head and the charge of a dissimilar-metal powder material by a laser beam is developed. For example, the apparatus used for such a laser cladding processing method is indicated by JP,H7-185866,A.
[0003] In order to irradiate a laser beam at a circular doughnut-like valve-seat part, it is necessary to move a laser beam and a cylinder head relatively. The radiation position of the laser beam is fixed, and he carries out relative displacement of the cylinder head in the level surface to the radiation position of a laser beam, and is trying for a processing area to become doughnut-like in the case of the apparatus shown in JP,H7-185866,A. Moreover, the device in which the oscillating direction at the time of flat-surface irradiation of a laser beam can be freely changed to this apparatus by the laser beam irradiation equipment side is established. And both the movement zone in the level surface of a cylinder head and the oscillating direction of a laser beam are synchronized, and it is controlling so that the oscillating direction of a laser beam turns into one way in each location of a doughnut-like processing area, as shown in drawing 4 .

[0004] To the top face of a cylinder head, a predetermined inclination is attached and the valve pore prepared in a cylinder head on the other hand is formed, as shown in drawing 3 . For this reason, the degree of prescribed angle leans the cylinder head so that the metal ingredient which melted at the time of irradiation of a laser beam flows, and may not visit the central shaft orientations of a valve pore from a valve-seat part and the laser beam radiation position of a valve-seat part may become level to the gravity direction. It is desirable to irradiate a laser beam, rotating a cylinder head to the circumference of the main shaft of the valve-seat part valve pore for processing.

[0005] If such a point is taken into consideration, an apparatus as shown in drawing 5 can be considered. theta shaft drive motor 122 fixed to the base 120 of the apparatus shown in drawing 5 rotates the table 126 which fixes a cylinder head 124 to the circumference of theta shaft. The turntable 128 with which the table 126 was fixed to the drive shaft of theta shaft drive motor 122, The relative position [as opposed to this slide block 132 in a cylinder head 124] is being fixed including the guide rail 130 placed in a fixed position on this turntable 128, and the slide block 132 which slides along with this guide rail 130.

[0006] A slide block 132 has the deduction hole 134, and these support either the inlet port of a cylinder head, or the exhaust port. That is, the main shaft of this deduction hole 134 is in agreement with the main shaft of a valve hole. Moreover, the lock-pin 136 which can move at that core in theta shaft orientations is arranged, and actuation of this attitude is performed to the drive shaft of theta shaft drive motor 122 by the actuators 138, such as a lock-pin actuation cylinder. When this lock-pin 136 marches out, it is inserted into said deduction hole 134, and positioning to the turntable 128 of a slide block 132 is performed.

[0007] If theta shaft drive motor 122 rotates where this positioning is made, a cylinder head will rotate to the circumference of the valve pore core shaft corresponding to [deduce and] a hole 134 with which the lock-pin 136 was inserted. If laser beam irradiation equipment is fixed so that a laser beam may be irradiated by the location which only the radii of the valve seat separated from this valve pore core shaft, laser cladding processing will be performed over the valve-seat perimeter by the revolution of the aforementioned cylinder head. In addition, since the oscillating direction of a laser beam is fixed to the radial direction of a valve pore, all the oscillating directions of the laser beam in each location of a processing area turn into this direction. Moreover, it is hard to flow through the metal ingredient which melted since it became the level surface, and the valve-seat location where the laser beam is irradiated can perform good laser cladding processing.

[0008] When processing it to the valve-seat part of the following valve pore, the lock-pin 136 is evacuated, it deduces and engagement in a hole 134 is solved, and the connecting pin 142 is inserted in the connection hole 140 established in the slide block 132 simultaneously with this. And it deduces through the connecting pin 142 and a connection hole 140, and a slide block

132 is slid by a motor 144, and the deduction hole 134 corresponding to the valve pore for [of the following] processing is deduced in the location of the lock-pin 136. And the lock-pin 136 is inserted in this deduction hole 134. The above action is repeated and the valve-seat part of each valve pore is processed.

[0009]

[Problem to be solved by the invention] As mentioned above, [according to the apparatus shown in drawing 5 , can perform uniform processing over the perimeter of a valve-seat part, but] Whenever processing of one valve-seat part was completed, the above deduction actions needed to be performed to the following valve-seat part, and there was a problem that this deduction action will take much time. Especially, engagement of the connecting pin 142 and a connection hole 140 and separation will be performed for every deduction action, and much time may be spent on this actuation.

[0010] Furthermore, since the pitch usually differs in the exhaust air system port and the suction system port, it cannot perform simply using a slide block 132 for processing of both a suction system and an exhaust air system. Therefore, after processing of the port which is one side first, for example, an exhaust air system port valve seat part, is completed, processing of the remaining suction system port side valve-seat parts will be performed. For this reason, two processing apparatus as shown in drawing 5 were prepared, the suction system port needed to be processed by one side, and the valve-seat part of the exhaust air system port needed to be processed on the other hand. However, the activity which puts a cylinder head 124 on the processing apparatus of another side again from one processing apparatus in this case is very troublesome, and requires time. Furthermore, the tooth space for placing two apparatus is also needed. Of course, the slide block for intake air and exhaust ports is prepared, respectively, and although rearranging these suitably is also considered, the time and effort for a provision substitute and time will be required also in this case.

[0011] Furthermore, a certain amount of clearance is required for the lock-pin 142 and a connection hole 140, and there is also a fear of this clearance reducing the accuracy of deduction, as a result causing lowering of processing accuracy.

[0012] It is made in order that this invention may solve the above troubles, and it aims at shortening the deduction and the make-ready time of a cylinder head in laser cladding processing.

[0013]

[Means for solving problem] In order to attain the above-mentioned object, [a laser cladding processing apparatus according to claim 1] In the laser-beam-machining apparatus for valve-seat welding a metal ingredient of an engine cylinder head The laser radiation apparatus which irradiates a laser to a BABUSHITO part, and the installation base for holding a cylinder head in a predetermined location, The rotation means for being prepared in a machine stool and

rotating said installation base to the circumference of a predetermined revolving shaft, Said installation base can be freely moved continuously in a two-dimensional flat surface, and it has an installation base positioning device for coinciding the hole-axis alignment and said predetermined revolving shaft of the valve-seat part to process, and is characterized by an installation base positioning device intervening between said installation base and said rotation means.

[0014] Moreover, with the laser-beam-machining apparatus according to claim 2, it is characterized by establishing the installation base include-angle alteration device in which the include angle to said revolving shaft can change said installation base by predetermined within the limits further in addition to a laser-beam-machining apparatus according to claim 1.

[0015] furthermore, [the laser-beam-machining approach according to claim 3] The laser radiation apparatus which irradiates a laser to a valve-seat part, and the installation base for holding a cylinder head in a predetermined location, The rotation means for being prepared in a machine stool and rotating said installation base to the circumference of a predetermined revolving shaft, Can move said installation base continuously freely in a two-dimensional flat surface, and it intervenes between said installation base and said rotation means. The installation base positioning device for coinciding the hole-axis alignment and said predetermined revolving shaft of the valve-seat part to process, The laser-beam-machining apparatus equipped with the installation base include-angle alteration device in which the include angle to said revolving shaft can change said installation base by predetermined within the limits is used. After termination of laser beam machining which makes the 1st valve-seat part weld a metal ingredient, In performing laser beam machining of the 2nd valve-seat part, the 2nd hole-axis alignment and said revolving shaft of a valve-seat part are coincided according to said installation base positioning device and said installation base include-angle alteration device. The laser-beam-machining apparatus of a description is used for description Claim 2 for processing it, rotating an installation base to the circumference of said revolving shaft, where the location adjusted to after an appropriate time by the installation base positioning device and the installation base include-angle alteration device is fixed. In performing laser beam machining of the valve-seat part after [2nd] termination of processing for the 1st valve-seat part The 2nd hole-axis alignment and said revolving shaft of a valve-seat part are coincided according to said installation base positioning device and said installation base include-angle alteration device. It is characterized by processing it, rotating an installation base to the circumference of said revolving shaft, where the location adjusted to after an appropriate time by the installation base positioning device and the installation base include-angle alteration device is fixed.

[0016] The revolving-shaft alignment of an installation base and the valve hole-axis alignment of the valve-seat part to process are united according to an installation base positioning

device, and it is made for a valve-seat part to be located in the radiation position of a laser beam according to architecture according to claim 1. And if a laser beam is irradiated rotating an installation base by a rotation means in this condition, uniform processing can be performed over the whole valve-seat part. And since it is considered as the device to which the conventional installation base location is freely moved continuously in a two-dimensional flat surface compared with what is intermittently positioned using a positioning pin, even when it is processing of the cylinder head of the class from which adjustment of an installation base location is prompt, and differs, a response can be done easily.

[0017] [the processing method of Claim 3] since the include angle of the installation base to an installation base revolving shaft can be changed further If this is used with an installation base positioning device from the valve-seat part of an exhaust air system port at the time of the valve-seat part of a suction system port, or alteration of the reverse processing position, alteration of a processing position can be performed easily.

[0018]

[Effect of the Invention] Thus, in invention according to claim 1 or 2, since it has the installation base positioning device which can move freely and continuously in a two-dimensional flat surface in an installation base, adjustment of an installation base location is prompt, and does so the effectiveness that processing of the cylinder head of a different class can also be performed easily.

[0019] According to invention according to claim 3, [part / exhaust air system port side valve-seat / part / suction system port side valve-seat] Or alteration of the processing position in that case of being reverse is easy, therefore processing of the valve-seat part of an exhaust air system and a suction system can be performed without needing the activity of putting a cylinder head on an installation base again.

[0020]

[Mode for carrying out the invention] The form of the suitable operation about the laser-beam-machining apparatus about this invention and a processing method is explained using Drawings below.

[0021] Drawing 1 and drawing 2 are drawings showing the architecture of the laser cladding processing apparatus 1 of the form of this operation, drawing 1 is a perspective view and drawing 2 is a side elevation. The field 3 to which about 45 degrees inclined to the level surface is established in the machine stool 2, and the servo-motor 4 for a revolution which is a rotation means so that a revolving shaft may become vertical to this field 3 attaches, and is being fixed. 5 is a rotary table, it is connected with the revolving shaft of the servo-motor 4 for a revolution through a reducer 6, and it can be rotated when the servo-motor 4 for a revolution rotates. In addition, although the case where the revolving shaft theta of the rotary table 5 and the revolving shaft of the servo-motor 4 for a revolution are in agreement with drawing 1 and

drawing 2 is shown, as long as it is not necessary to make it not necessarily in agreement and the rotational torque of the servo-motor 4 for a revolution is transmitted to the rotary table 5, what kind of form is sufficient as this.

[0022] On the rotary table 5, the Y-axis guide rail 7 is arranged in the direction of Y of drawing 1 , and the Y-axis slide block 8 which engages with the Y-axis guide rail 7 is formed movable along with the Y-axis guide rail 7. It is an axle hole to use the ball screw nut device, for the servo-motor for the Y-axes for 9 to rotate a ball screw, for 10 rotate a nut, and for 11 rotate a ball screw 9 and 12 support a reducer as a dislodging device of the Y-axis slide block 8, and for 13 support a ball screw 9.

[0023] On the Y-axis slide block 8, the X-axis guide rail 14 is arranged in the direction of X of drawing 1 , and the X-axis slide block 15 which engages with this is formed movable along with X shaft guide rail 14. The dislodging device of the X-axis slide block 15 is the same as the dislodging device of the Y-axis slide block 8, and, as for a ball screw and 18, 16 is [a reducer and 20] axle holes a nut and 19 an X-axis servo-motor and 17.

[0024] On the X-axis slide block 15, the installation base 23 for positioning a cylinder head 22 in a predetermined location, and fixing through the splash device 21, is formed. In addition, although not illustrated in the installation base 23, the clamp device for fixing a cylinder head 22 is prepared in it.

[0025] Although the example of the cylinder head in which four valve pores [two] per cylinder, i.e., an exhaust air system valve pore, and two suction system valve pores were formed by the 4-cylinder is shown in drawing 1 As shown also in drawing 3 , when processing the valve-seat part of one of valve pores for a differing [the axial centers AexAin of a valve pore /, respectively]-by exhaust air system and suction system reason, it is necessary to unite said rotary-table 5 revolving shaft theta and the axial center of a valve pore in parallel. It is for the splash device 21 changing the direction of the axial center of the valve pore of a suction system, the include angle to revolving shaft theta, i.e., the exhaust air system, of said rotary table 5 of a cylinder head 22, to two locations. Either the axial center Aex of the valve pore of an exhaust air system formed in the cylinder head 22 of this or the axial center Ain of the valve pore of a suction system can be made parallel with the revolving shaft theta of said rotary table 5. 24 is a splash motor for changing the inclination of said installation base 23, and the splash device 21 can be realized by connecting the revolving shaft of this servo-motor 24 with an installation base. Moreover, the splash include angle of said installation base 23 is freely changeable by giving a command signal to a servo-motor 24 freely from the outside.

[0026] Connect with the control device which omitted the graphic display, respectively, and said servo-motor 4 for a revolution, the Y-axis servo-motor 11, the X-axis servo-motor 16, and the splash motor 24 are controlled systematically. It is possible to move a cylinder head 22 to arbitrary sense again in locations arbitrary in a X-Y flat surface by the thing which carry out

drive controlling of the servo-motor 4 for a revolution, the Y-axis servo-motor 11, and the X-axis servo-motor 16 especially, respectively and to do. In addition, the mechanical motor locking device is established from the need of fixing a cylinder head 22 to the servo-motor 4 for a revolution, the Y-axis servo-motor 11, the X-axis servo-motor 16, and the splash motor 24 with a certain location or a certain sense.

[0027] Although not illustrated above the machine stool 2, laser beam irradiation equipment is arranged, and although the fine adjustment of the radiation position and focusing position of a laser beam is possible, they are fundamentally considered as anchoring. In addition, detailed description is omitted although the material supplying discharge jet for supplying the metal-powder object ingredient made to weld to the valve-seat part for processing and the shielding gas nozzle for shielding gas feed are prepared between the radiation position of a laser beam, and a machine stool.

[0028] Next, the laser cladding processing method using the laser cladding processing apparatus of the form of this operation is explained. Let the installation base 23 be the basis which is in an initial position on a X-Y flat surface. First, a cylinder head 22 is put on the installation base 23, and positioning anchoring is carried out according to a clamp device. And according to the splash device 21, a cylinder head 22 is leaned so that the axial center Ain of the valve pore of a suction system may become parallel to the revolving shaft theta of the rotary table 5. And the X shaft motor 16 and the Y shaft motor 11 are driven, and the X-axis slide block 15 and the Y-axis slide block 8 are moved so that the valve hole-axis alignment Ain of the valve-seat part first for processing (for example, thing at the very end of a suction system valve) may be in agreement with the revolving shaft theta of the rotary table 5. Since the rotation from the initial position of the movement magnitude of each slide block, i.e., X, and the Y shaft motors 16 and 11 is beforehand memorized to the control device If feedback control of a location is performed based on the signal from an encoder 25 formed in each servo-motor, the installation base 23 can be correctly positioned to a target position. In addition, when the installation base 23 is located first in the arbitrary locations on a X-Y flat surface, the encoder of the X-axis and the Y-axis servo-motors 16 and 11 should just perform feedback control of a location based on the information on a current position and a target position (all are absolute positions) using what can detect an absolute position.

[0029] If the installation base 23 can position to a target position, it fixes to the location which had the installation base 23 positioned using the motor locking device of X and the Y-axis servo-motors 16 and 11. If the rotary table 5 is rotated using the servo-motor 4 for a revolution and a powder metal ingredient and shielding gas are supplied while irradiating the target valve-seat part to a laser beam after an appropriate time, uniform laser cladding processing will be performed over the perimeter of a valve-seat part. In addition, adjustment shall be carried out to the location beforehand predetermined in the radiation position and focusing position of a

laser beam.

[0030] If processing of the first valve-seat part is completed, the lock of the X-axis and the Y-axis servo-motors 16 and 11 will be canceled. The X-axis and the Y-axis servo-motors 16 and 11 are driven, and X and the Y slide blocks 15 and 8 are moved so that the axial center Ain of the following valve pore (the next suction system valve pore) may be in agreement with the revolving shaft theta of the rotary table 5. After positioning of an installation base is completed, it becomes the same action as the above-mentioned. In addition, if the position (decided by the rundown location of the servo-motor 4 for a revolution) of a cylinder head 22 turns into a position like drawing 1 for every processing, it is clear that positioning's to the following valve pore what is necessary is to drive only Y shaft motor.

[0031] Thus, if processing of all the suction system valve-seat parts is performed, the installation base 23 (namely, cylinder head 22) will be leaned so that the axial center Aex of an exhaust air system valve pore may become parallel to the revolving shaft theta of the rotary table 5 shortly according to the splash device 21. And the axial center of the exhaust air system valve pore for processing is coincided with the revolving shaft theta of the rotary table 5, and laser cladding processing is performed. Positioning of the valve-seat part for [of the following] processing is the same as that of the case of the above-mentioned suction system. If all the processings, i.e., 16 processings, are completed, an apparatus will be stopped, a cylinder head 22 is removed from the installation base 23, and it sends to the following processing process. In addition, the cylinder head 22 to which laser cladding processing was performed is sent to a cut or a grinding operation, and further processing of a valve-seat part is performed.

[0032] As mentioned above, since the installation base 23 where the cylinder head 22 was fixed can be freely positioned continuously at a X-Y flat surface with X and Y slide block according to the laser cladding processing apparatus of the form of this operation, positioning of a valve-seat part can carry out very easily and promptly. Moreover, even when processing the cylinder head of a different class, since it can respond in [only setting the positioning data of X and the Y-axis servo-motors 16 and 11 as a control device] soft, the flexibility of an apparatus becomes high. Furthermore, [the base] since the installation base 23 can change an include angle according to the splash device 21 It is not necessary to put a cylinder head 22 on the installation base 23 again also in the case of alteration of the processing position from a suction system valve-seat part to an exhaust air system valve-seat part, and processing of all the valve-seat parts does so the outstanding effectiveness that it can perform continuously.

[0033] Since the X-axis and the Y-axis servo-motors 16 and 11 are formed on the rotary table 5 in the case of the apparatus of the form of this operation, the debt by the revolution of various lines, such as a current supply source line to each servo-motor and a signal line from an encoder, becomes a problem. However, if a sliding contact is used for an exchange of an

external energizer, a current with an external-control apparatus, and a signal in this case, the problem of a debt of various lines will be solved. Moreover, when worrying about the dependability of an exchange of the signal by a sliding contact, only a part for the number of times of the highest revolution of a rotary table is made into the wiring state which can get various lines twisted, carries out counterrotation of the rotary table 5 for every processing of one cylinder block, and should just solve a debt.

[0034] Moreover, since anchoring of the location of the installation base 23 is made into the motor locking device of the X-axis and the Y-axis servo-motors 16 and 11 in the case of the apparatus of the form of this operation, it is necessary to secure the strength of motor locking for the grade which can bear the centrifugal force by revolution of the rotary table 5.

[0035] As mentioned above, although the embodiment of this invention has been explained, it does not pass over this to an example, but various alterations of an embodiment are possible within the limits of this invention.

[Brief Description of the Drawings]

[Drawing 1] The perspective view showing the architecture of the laser cladding processing apparatus about this invention.

[Drawing 2] The side elevation of the laser cladding processing apparatus about this invention.

[Drawing 3] Detail drawing of the valve-seat part which performs laser cladding processing.

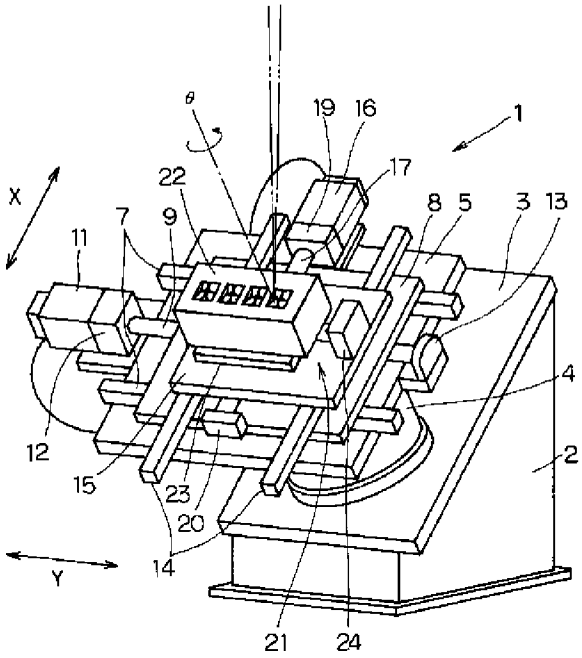
[Drawing 4] The explanatory view of the oscillating direction of the laser beam to a valve-seat part.

[Drawing 5] The perspective view explaining the architecture of the conventional laser cladding processing apparatus.

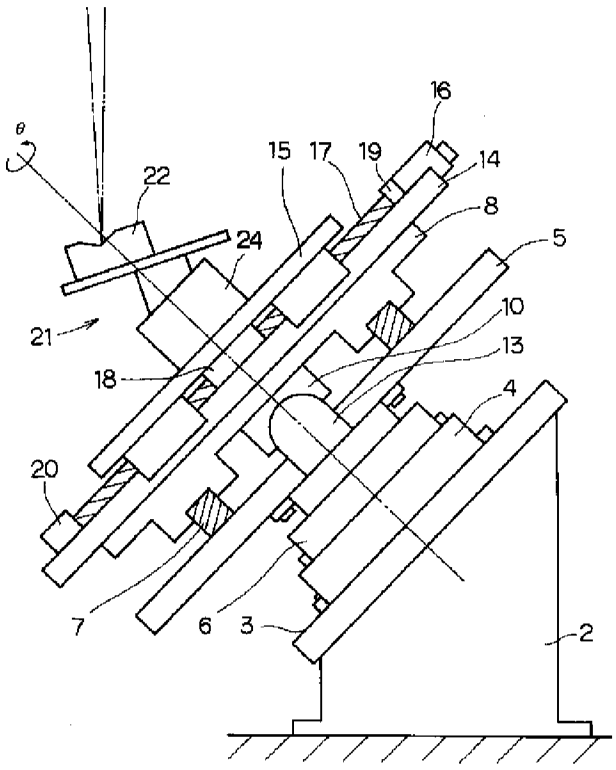
[Explanations of letters or numerals]

2 Machine Stool, 4 Servo-motor for Revolution, 5 Rotary Table, 6 Reducer, 7 A Y-axis guide rail, 8 A Y-axis slide block, 11 Y shaft motor, 14 An X-axis guide rail, 15 An X-axis slide block, 16 An X-axis servo-motor, 21 A splash device, 22 A cylinder head, 23 Installation base 24 A splash motor, 25 Encoder.

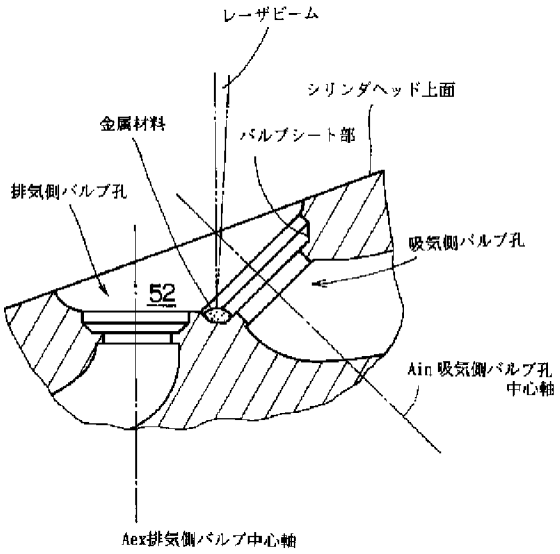
[Drawing 1]



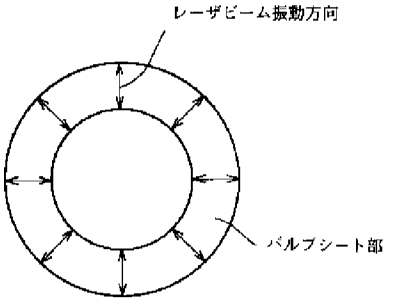
[Drawing 2]



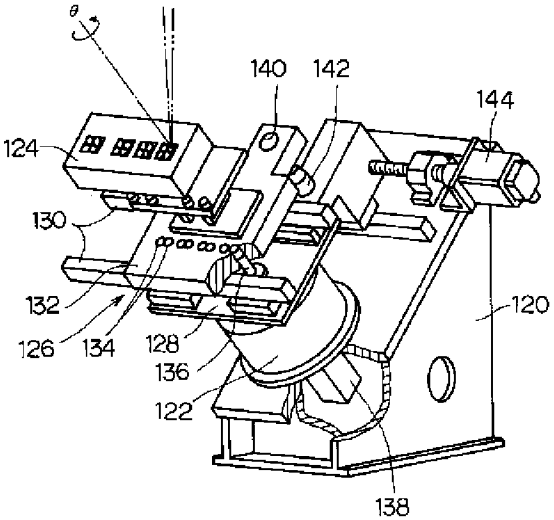
[Drawing 3]



[Drawing 4]



[Drawing 5]



[Translation done.]